1. Module details

Module name

Applied Electricity 2

Suggested structured learning time

A learner possessing the prerequisite skills and knowledge should achieve the module purpose in 36-40 hours.

Module code

NUE054

Discipline code

0703120

2. Module purpose

In this module Learners will expand their knowledge of the relationship between voltage, current and resistance and the power dissipated in circuits. They will gain knowledge of common resistor types and the factors affecting resistance and the basic concepts of capacitance and inductance.

Also, Learners will further develop skills in electrical measurement and working with and solving problems in series, parallel and series/parallel single source dc circuits.

3. Learning pathway

Intended use in the structured learning program

This module expands the introduction to electrical theory and is intended to supplement exposure to electrical/ electronic work. Before undertaking this module a student should have a general understanding what electrical/electronic work entails and the need to work safely particularly when dealing with electricity.

Recommended prerequisites

For the most effective learning this module should be undertaken only after module NUE052 Applied Electricity 1 has been completed.

4. Relationship to competency standards

This module provides part of the underpinning knowledge and skills in the 'Evidence Guide' of specific units of competency in the National Electrotechnology Training Package and provides similar support, where mapped, to equivalent units in the National Metals and Engineering Competency Standards. For details refer to the module to unit maps, available from EEQSBA.

This module supports the development of essential capabilities required for electrical licensing.

5. Content

1. Factors affecting resistance
    - length, csa, resistivity
    - temperature change
    - influence on practical circuits

2. Resistors
   - types and applications
   - value and rating
3. Series circuits (single source)
   - determine V, I, R, P
   - Kirchhoff's Voltage Law ($\sum Vd = E$)
   - voltage divider
4. Parallel circuits
   - determine V, I, R, P
   - Kirchhoff's Current Law ($\sum Iin = \sum Iout$)
   - current divider
5. Series / parallel circuits
   - determine V, I, R, P
   - bridge network
6. Resistance measurement
   - hazards
   - characteristics of instruments and loading effect
   - direct, volt-ammeter and bridge method
   - typical field instruments and applications (introduction)
7. Capacitance
   - concept
   - units
   - time constant relationship
8. Capacitors
   - hazards
   - factors affecting capacitance
   - in series
   - in parallel
   - measuring / testing

9. Inductance
   - concept
   - units
   - time constant relationship

10. Inductors
   - factors affecting capacitance

6. Assessment strategy

Assessment methods

Assessment should be progressive reflecting an holistic approach to ensure the module purpose is met. To assist in ensuring validity, reliability and fairness assessment instruments should include practical exercises, assignments and written tests consisting of a number of item types, such as multiple choice, short answer and problem solving.

Conditions of assessment

Normally learning and assessment will take place in a classroom/ laboratory environment

7. Learning outcome details

Learning outcome 1

Discuss the factors affecting resistance and determine their influence on practical circuits and devices.

Assessment criteria

1.1 Show how length, cross-sectional area and material effect the resistance of conductors.

1.2 Describe effects of temperature change on the resistance of various conducting materials.

1.3 Determine the resistance of a conductor from factors such as conductor length, cross-sectional area, resistivity and changes in temperature.

1.4 Explain the effects of resistance on the current-carrying capacity and voltage drop in cables.

Learning outcome 2

Discuss the features of common practical resistors and determine the suitability of a resistor for a given purpose.

Assessment criteria

2.1 Describe the features of fixed and variable resistor types and typical applications.

2.2 List the characteristics of temperature, voltage and light dependent resistors and typical applications of each.

	2.3 Specifying a resistor for a particular application.
	2.4 Determine the resistance of a colour coded resistor from colour code table and confirm the value by measurement.
Learning outcome 3	Work with single-source series dc circuits and solve problems related to voltages, currents, resistances and power dissipated in such circuits.
Assessment criteria	3.1 Set up and connect a single-source series dc circuit.
	3.2 Take resistance, voltage and current measurements in a single source series circuit.
	3.3 Determine the voltage, current, resistances and power dissipated from measured or given values of any two of these quantities.
	3.4 Describe the relationship between the voltage drops around a circuit and the applied voltage.
	3.5 Show the relationship between voltage drops and resistance in a simple voltage divider network.
Learning outcome 4	Work with single-source parallel circuits and solve problems related to voltages, currents, resistances and power dissipated in such circuits.
Assessment criteria	4.1 Set up and connect a single-source parallel circuit.
	4.2 Take resistance, voltage and current measurements in a single-source parallel circuit.
	4.3 Determine the voltage, current, resistance and power dissipated from measured or given values of any of these quantities.
	4.4 Describe the relationship between currents entering a junction and currents leaving a junction.
	4.5 Show the relationship between branch currents and resistances in a two branch current divider network.
Learning outcome 5	Work with single source series / parallel circuits and solve problems related to voltages, currents, resistances and power dissipated in such circuits.
Assessment criteria	5.1 Set up and connect a single-source series / parallel circuit.

	5.2 Take resistance, voltage and current measurements in a single-source series / parallel circuit.
	5.3 Determine the voltage, current, resistances and power dissipated from measured or given values of any two of these quantities.
	5.4 Show the relationship between voltages, currents and resistances in a bridge network.
Learning outcome 6	Take accurate measurements of voltage, current and resistance and identify typical instruments used in the field.
Assessment criteria	6.1 Identify the hazards involved in using electrical instruments and the safety control measures that should be taken.
	6.2 Compare the operating characteristics of analogue and digital meters.
	6.3 Select an appropriate meter in terms of units to be measured, range, loading effect and accuracy for a given application.
	6.4 Measure resistance using direct, volt-ammeter and bridge methods.
	6.5 Identify instruments used in the field to measure voltage, current and resistance and the typical circumstances in which they are used.
Learning outcome 7	Demonstrate an understanding of the concepts of capacitance, the units by which it is measured and the characteristics of series dc circuits containing resistance and capacitance.
Assessment criteria	7.1 Define capacitance and explain how a capacitor is charged and discharged in terms of its electrostatic field.
	7.2 Define the units by which capacitance is measured.
	7.3 Show the relationship between capacitance, voltage and charge.
	7.4 Show how a series d.c. circuit containing resistance and capacitance behaves.

Learning outcome 8	Discuss the factors affecting capacitance and methods for measuring / testing capacitors.
Assessment criteria	8.1 Identify the hazards involved in working with capacitance effects and the safety control measures that should be taken. 8.2 List the factors which determine the capacitance of a capacitor and explain how these factors are present in all circuits to some extent. 8.3 Show the effects of capacitors connected in parallel by calculating their equivalent capacitance. 8.4 State the effects on the total capacitance of capacitors connected in series. 8.5 Describe common faults in capacitors. 8.6 Determine through measurement whether a given capacitor is serviceable.
Learning outcome 9	Demonstrate an understanding of the concepts of inductance, the units by which it is measured and the characteristics of series dc circuits containing resistance and inductance.
Assessment criteria	9.1 Define inductance and explain how an inductor stores energy in the form of a magnetic field. 9.2 Define the units by which inductance is measured is measured. 9.3 Show how a series d.c. circuit containing resistance and inductance behaves.
Learning outcome 10	Discuss the factors affecting inductance.
Assessment criteria	10.1 List the factors which determine the inductance of an inductor and explain how these factors are present in all circuits to some extent.

8. Delivery of the module

Delivery strategy	Delivery strategies must be suitable for learning both theoretical and practical aspects described in the module purpose. It is considered that the most effective method to achieve this is by integration of theory and practice where students learn by experimentation, research and reports. It is recommended that learning and assessment be facilitated in a holistic manner that may require a learning outcome sequence other than that indicated in the module.
Resource requirements	Resources should be sufficient for students to carry out exercises on an individual basis. Useful references include: Jenneson, J. R. 1996, *Electrical Principles for Electrical Trades,* 4th Ed., McGraw Hill, Sydney Batty, I. 1996, *Electrical Principles*. Prentice Hall, Sydney. Van den Bergen, B. 1996, *Mathematics for the Electrical Trades*. TAFE Publications, RMIT, Melbourne Standards Australia, Standards New Zealand: AS/NZS 4836 *Safe working practice on low-voltage electrical installations* WorkCover Codes of Practice Where this module is used in an approved Traineeship or Apprenticeship program learners should be advised to obtain, where available, respective EEQSBA[1] ***User Guides*** (*these outline in detail what training and work performance the Learner is required to undertake for the program*).
Occupational health and safety requirements	A safe and healthy environment will be provided for learners and teachers. Safety procedures for the particular learning facilities shall be followed as part of the learning / teaching activity and assessment.

[1] EEQSBA – ElectroComms and EnergyUtilities Qualifications Standards Body of Australia Ltd.